Claims

What is claimed is:

1. A method for detecting damage to a portion of a die of an integrated circuit comprising the steps of:

applying a particle suspension solution to the die; and

identifying at least one damaged region of the portion of the die as an area having an accumulation of particles of the particle suspension solution.

2. The method of claim 1, wherein the portion of the die comprises a dielectric film of the die.

3. The method of claim 1, wherein the particle suspension solution comprises suspended particles in an electrolyte.

4. The method of claim 2, wherein the particles comprise at least one of tungsten, copper and latex spheres.

5. The method of claim 4, wherein the particles comprise latex spheres and further comprising the step of dying the latex spheres.

6. The method of claim 3, wherein the electrolyte comprises a low to moderate concentration phosphate buffer, approximately 10^{-4} mol dm^{-3} to 10^{-1} mol dm^{-3}.

7. The method of claim 6, wherein the phosphate buffer has a pH that is greater than approximately 3.7 and less than approximately 9.0.

8. The method of claim 2, wherein a surface potential of at least one of the particles is approximately 10-20% greater than a surface potential of the dielectric film, and wherein the surface

potential of at least one of the particles is opposite in sign to the surface potential of the dielectric film.

9. The method of claim 2, wherein a diameter of at least one of the particles is less than approximately 50% of a mean peak-to-valley dielectric film roughness value.

10. The method of claim 9, wherein the mean peak-to-valley dielectric film roughness value is approximately 0.01 to 1.0 μm.

11. The method of claim 2, wherein a diameter of at least one of the particles is approximately 50% of a mean peak-to-peak dielectric film roughness value.

12. The method of claim 11, wherein the peak-to-peak dielectric film roughness value is approximately 0.5 to 10.0 μm.

13. The method of claim 1, wherein the method is performed during integrated circuit manufacturing after wire bonding the die to a leadframe.

14. The method of claim 1, wherein the method is performed during failure mode analysis after removal of packaging and etching away of metal stacks and wire bonds.

15. The method of claim 1, wherein the step of applying a particle suspension solution comprises the step of immersing the die and an associated base plate in an approximately 30% hydrogen peroxide solution at approximately 50-60° C.

16. The method of claim 15, wherein tungsten particles are formed in the particle suspension solution if the base plate comprises tungsten.

17. The method of claim 15, wherein copper particles are formed in the particle suspension solution if the base plate comprises copper.

18. The method of claim 1, wherein the step of applying a particle suspension solution comprises the step of immersing the die and an associated base plate in a solution comprising potassium dihydrogen phosphate, potassium hydroxide, and potassium hexacyanoferrate III in water.

19. A particle suspension solution for detecting damage to a portion of a die of an integrated circuit, wherein the particle suspension solution is applied to the die for identifying at least one damaged region of the portion of the die as an area having an accumulation of particles of the particle suspension solution.

20. A die of an integrated circuit having a particle suspension solution applied thereto for identifying at least one damaged region of a portion of the die as an area having an accumulation of particles of the particle suspension solution.